Remarks

This is in response to the Office Action dated September 30, 2004. The Office Action first objected to claims 3-6 and 19 as being in improper form. The Office Action next rejected claims 1-8 under 35 U.S.C. §112, first paragraph as not being enabled by the specification. The Office Action next rejected claims 1-25 under 35 U.S.C. §112, second paragraph as being incomplete for omitting essential structural cooperative relationships of elements. The Office Action next rejected claims 1, 7-9, 11, 15-17 and 23-25 under 35 U.S.C. §103(a) as being unpatentable over U.S. Patent Number 5,852,633 to Levin ("Levin") in view of U.S. Patent Number 6,456,657 to Yeap ("Yeap"). Finally, the Office Action indicated that claims 2, 10, 12-14 and 18-22 are allowable, assuming claim 19 is corrected in order to overcome the rejection of that claim under 35 U.S.C. §112, second paragraph. Applicants appreciate the recognition of allowable subject matter.

In response to the claim objection and the rejections of claims under 35 U.S.C. §112, first and second paragraphs, applicants have amended claims 1, 3, 9, 17 and 25. Applicants traverse the rejections of claims 1, 7-9, 11, 15-17 and 23-25 under 35 U.S.C. §103(a). Claims 1-25 remain under consideration.

Claim Objection: Claims 3-6 and 19

The Office Action first objected to claims 3-6 and 19 as being in improper form. Specifically, the Office Action pointed out that claims 3 and 19 each refer to two separate claims, but that those claims are not referred to in the alternative. As a result, claims 3 and 19 are not proper multiple dependent claims. Claims 4-6 were objected to as depending on rejected claim 3

Applicants have amended claim 3 to remove the reference to claim 1 as well as to more clearly claim that which Applicants regard as the invention. As a result, claim 3 is now directly dependent only upon claim 2.

Applicants have amended claim 19 as was discussed in the examiner telephone interview referenced in the Office Action. Specifically, in line 1 of claim 19, the phrase

"claim 17" was changed to "claim 18" and, in line 3 of claim 19, the phrase "needed for the steps of claim 18" was removed.

As a result of these amendments, the objections to claims 3-6 and 19 have been overcome. Applicants hereby respectfully request the withdrawal of those objections.

35 U.S.C. §112, First Paragraph Rejection: Claims 1-8

The Office Action next rejected claims 1-8 under 35 U.S.C. §112, first paragraph, stating that those claims did not enable the claim 1 element of "where bins flagged by the pre-filtering step remain unexcluded, said scheme excludes the bins flagged in the pre-filtering step." The Office Action states that this phrase contradicts the specification at, for example, page 6, lines 15-19.

Applicants believe that the Examiner has misread claim 1. Specifically, the above-cited element should be read "where bins flagged by the pre-filtering step remain unexcluded," then the scheme excludes those bins. This is precisely what is disclosed at page 6, lines 15-19 and, generally, throughout the specification. More particularly, the passage at page 6, lines 15-19 states that:

> [t]he repeated-bisection power splitting and allocation unit is coupled to the pre-filtering unit and is used for implementing the repeated bisection of power scheme of the invention to allocate available power substantially optimally among a plurality of bands for DMT frequency tones, where bins flagged by the pre-filtering unit are excluded. Where desired, the initialization unit may receive notification of the flagged noisy bins from the prefiltering unit and exclude the flagged noisy bins.

Accordingly, this passage teaches that noisy bins flagged by the pre-filtering unit are excluded. Claim 1 is therefore enabled as originally filed.

However, in order to correct any perceived ambiguity in claim 1, applicants have amended the last element of claim 1 to claim:

> wherein at least a first flagged bin in said plurality of bins is excluded from being allocated power.

The teachings of claim 1 are fully supported by the specification, as discussed above. As a result, Applicants respectfully request the removal of the rejection under 35 U.S.C. §112, first paragraph.

35 U.S.C. §112, Second Paragraph Rejection: Claims 1-25

The Office Action next rejects claims 1-25 under 35 U.S.C. §112, second paragraph, stating that those claims are incomplete for omitting essential structural cooperative relationships of elements in those claims. Specifically, the Office Action states, for example, that there is no link in claim 1 between the initializer, prefilter, splitter, etc.

In response to this rejection, Applicants have amended independent claims 1, 9, 17 and 25 to more particularly point out and distinctly claim the invention. Regarding each of those claims, Applicants have added a phrase to the preamble stating that each tone "corresponds to a bin of a plurality of bins, each of said bins in said plurality representing a portion of a predetermined bandwidth". Support for this amendment can be found at least at page 10, lines 9 – 11, which states that "tone(s) to which power is allocated . . . is of a bandwidth that corresponds to (the) frequency bins." These frequency bins are predetermined since the repeated-bisection scheme bisects in a predetermined fashion the respective frequency to be split.

The amended step of calculating (claims 1 and 17) and the initialization unit (claims 9 and 25) have been amended to include the element of "calculating for each of said bins" aggregate values . . . Support for this amendment may be found in the specification at least at page 16, lines 5-10, which states that "(e)ach of 2^j elements of a noise power vector to be used at step-j may be calculated as a sum of noise power values in bins aggregated for the step-j, where j=1, . . .,8."

Finally, the step of pre-filtering (claims 1 and 17) and the pre-filtering unit (claims 9 and 25) have been amended to include the element of pre-filtering bins "as a function of at least one of said channel attenuation, noise power and power mask . . ." Support for this amendment may be found in the specification at page 9, lines 13-17, which states, regarding pre-filtering, that the "number of bits that can be received in a bin with (a) desired bit error rate (BER)" is calculated "when the tone is transmitted with a power level that is equal to that specified by the power mask value at the frequency bin."

Thus, in the disclosed prefiltering, for a given power level a number of bits that can be received in a bin is calculated. Thus, this calculation is a function, and hence the prefiltering method, is a function of the power level.

The remaining elements of claims 1, 9, 17 and 25 are clearly linked to one another as originally drafted. Specifically, the third element of each claim associated with "repeated-bisection splitting" contains the element of "the available power" which is clearly referring to the "maximum power available" in the second claim element of claims 1, 9, 17 and 25. Similarly, the amended last element of claim 1, which is not present in claims 9, 17 or 25, refers to "at least a first bin in said plurality of bins is excluded before or during the allocation of said available power," which clearly refers to the preamble, first element and third element of claim 1.

No new matter has been introduced as a result of the foregoing amendments since each of those amendments if supported at least at the above sections of the specification. Accordingly, for the foregoing reasons, independent claims 1, 9, 17 and 25 contain all necessary structural connections in order to conform to 35 U.S.C. §112, second paragraph. Each of dependent claims 2-8 and 10-16 and 18-24 refer specifically to an element of at least one of the claims upon which those claims depend. As a result, these claims also contain all necessary structural connections. Therefore, the rejections under 35 U.S.C. §112, second paragraph have been overcome. Accordingly, Applicants request the withdrawal of this rejection.

35 U.S.C. §103(a) Rejection: Levin in view of Yeap

The Office Action next rejected claims 1, 7-9, 11, 15-17 and 23-25 under 35 U.S.C. §103(a) as being unpatentable over Levin in view of Yeap. In order for an invention to be obvious under 35 U.S.C. §103(a), there must be some suggestion to combine or modify cited prior art references in a manner which would show or suggest all elements of the claimed invention. For the reasons discussed below, the Office Action fails to show that Levin in view of Yeap teach all elements of claims 1, 7-9, 11, 15-17 and 23-25. Applicants therefore request the withdrawal of the rejections of these claims under 35 U.S.C. §103(a).

The Levin reference teaches a method for allocating bits in the bins of an ADSL system and equalizing the Bit Error Rate (BER) of the bins without increasing the

aggregate transmit power. According to Levin, the bits are allocated by determining a projected margin that is calculated for each bin by subtracting a reference Signal-to-Noise Ratio (SNR) from an estimated bin SNR. The reference SNR of Levin is predetermined by theoretical calculation of empirical data and is stored in a look-up table. Bits are then removed from bins below the projected margin and assigned to the bin or bins having the highest projected margin.

The Yeap reference teaches a method and apparatus for processing an input signal for transmission and storage by using an analysis filter bank to decompose the signal into sub-band signals which are used to modulate a plurality of carriers. The carriers are combined into a single encoded signal for transmission/storage. Yeap also teaches that an encoder/decoder is especially applicable to telecommunications systems and recording systems. According to Yeap, a decoder receives a coded signal, demodulates those signals and synthesizes the demodulated signals to reconstruct the original input signal. In performing this synthesis, Yeap teaches that one or more of the sub-bands, especially at higher frequencies, may be discarded.

Claim 1:

A. Pre-filtering Step is not Taught by Levin or Yeap. The Office Action relies on Levin at Figure 6 (steps 612, 613 and 615) and Yeap column 2, line 12 as teaching the amended claim 1 element of:

> pre-filtering to flag, as a function of at least one of said channel attenuation, noise power and power mask, bins that are unable to support a minimum number of bits with a maximum power available for transmission in a bin.

Applicants disagree that Levin or Yeap teaches this claim element either alone or in combination.

Figure 6 of the Levin reference is described at column 6, line 46 – column 7, line 9 of that reference. In that description and in Figure 6, Levin teaches a process whereby a margin threshold value is defined. The bins having the worst SNR are selected and the bins having the best SNR are selected. The difference between the best and worst SNR values is calculated and compared to the defined margin threshold. If this difference is

greater than the threshold, then bits are removed from the worst bins and transferred to the best bins. This is very different than the above-recited claim element of claim 1.

Specifically, Levin does not teach the claim 1 element of flagging bins if those bins are "unable to support a minimum number of bits with a maximum power available for transmission in that bin." Figure 6 of Levin and the associated discussion merely teaches comparing a relative SNR of two or more bins and, if the difference between the SNR of those two or more bins is greater than a predetermined threshold, the bits in the worst bin(s) are transferred to the best bin(s). Thus, the teachings of this portion of Levin are different than the claim 1 step of pre-filtering.

The Office Action also states that column 2, line 12 of the Yeap reference teaches the above-recited claim 1 step of pre-filtering. In its entirety, the sentence of Yeap containing line 12 of column 2 states:

> It has been proposed to remedy this problem by adaptively eliminating noisy sub-channels, but to do so would involve very complex circuitry.

Thus, this portion of Yeap teaches away from the invention claimed in claim 1, which teaches excluding bins (sub-channels) if they are flagged in the pre-filtering step of claim 1. While this portion indeed mentions "adaptively eliminating noisy sub-channels", this is not the same as the pre-filtering step of claim 1. More particularly, the cited sentence of Yeap does not in any way teach pre-filtering, much less "pre-filtering to flag, as a function of at least one of said channel attenuation, noise power and power mask, bins that are unable to support a minimum number of bits with a maximum power available for transmission in a bin" as is claimed in amended claim 1. Thus, the teachings of this portion of Yeap are different than the amended claim 1 step of pre-filtering.

B. Repeated-Bisection Splitting Scheme is not taught by Levin or Yeap. The Office Action admits that Levin does not teach the claim 1 step of:

> using a repeated-bisection splitting scheme to allocate the available power substantially optimally among said plurality of bins

Instead, the Office Action relies on the Yeap reference at Figure 7a, 7b, column 1 and column 2 as teaching this element. Applicants disagree.

The repeated-bisection splitting scheme as claimed in claim 1 is shown in Figure 1 of the specification in the present application and is discussed in the associated discussion at pages 7-9. This repeated-bisection splitting scheme is, illustratively, used during the initialization period of a DSL modem in order to allocate bits and power to the discrete tones/bins. The available power is split and assigned to two split bins in a repeated fashion whereby the frequency range of each bin and the power assigned to that range is repeatedly bisected. Thus, in the first step, one bin and the power assigned to that one bin is bisected into two bins. In the next step the power is allocated over four bins, followed by steps whereby power is bisected and split between 8 bins, 16 bins, 32 bins, 64 bins, 128 bins and 256 bins. Hence the term "repeated-bisection splitting scheme." As this power is split among the bins, those bins flagged according to the previously discussed pre-filtering step of claim 1 are not assigned power and that power is distributed to the other, unexcluded bins.

Yeap discusses the cited Figures 7a and 7b of that reference at column 9 lines 45-58. In that discussion, Yeap teaches the "illustrative operation of (an) encoder." In particular, that portion of Yeap teaches that Figure 7a shows the frequency spectrum of a simplified input signal that occupies a bandwidth having a center frequency. Yeap then teaches that Figure 7b shows how, after analysis filtering and interpolation, the input signal has been partitioned into three interpolated sub-band signals. This is clearly different than the repeated-bisection splitting scheme as described above.

Columns 1 and 2 of Yeap, also cited by the Office Action as teaching a repeated bisection splitting scheme, is a very extensive passage of that reference. However, in this passage, Applicants cannot locate any reference to a bisecting scheme of any type, including a repeated-bisection splitting scheme as claimed in claim 1. That passage of Yeap discloses at column 1, lines 49-51 that "[i]t has been proposed to . . . divide the transmission system into a set of frequency indexed sub-channels." Column 1, lines 64-66 further teaches that "[t]he data to be transmitted is divided into multiple data streams which are used to modulate multiple carriers." And column 2, lines 33-36 teaches that "[a] disadvantage of both DMT and DWMT systems is that they typically use a large

number of sub-channels, for example 256 or 512, which leads to complex, costly equipment and equalization and synchronization difficulties."

Thus, once again, it appears that Yeap teaches away from the "disadvantage" of using a large number of sub-channels, such as are contemplated in at least one embodiment of the claimed present invention. More particularly, at no point in this passage of Yeap is it taught to bisect bins or the power assigned to the bins as is claimed in this element of claim 1.

For the foregoing reasons, neither Levin nor Yeap, either alone or in combination, teach the claim steps of pre-filtering or using a repeated-bisection splitting scheme. Accordingly, the Office Action has failed to show that each and every element of independent claim 1 is taught or suggested by those references. Therefore, claim 1 is allowable. As a result, claims 2-8 are allowable as being dependent upon an allowable base claim.

Claims 9, 17 and 25:

The Office Action rejected independent claims 9, 17 and 25 for the same reasons as discussed above in association with claim 1 and relies on the rejection of claim 1 when stating that the rejection is "as discussed above." Claims 9, 17 and 25 each contain amended claim elements substantially similar to the corresponding elements of claim 1. Thus, for the reasons discussed above in association with claim 1, neither Levin nor Yeap, alone or in combination, teach all the necessary elements of claims 9, 17 and 25. It follows that claims 9, 17 and 25 are not obvious over those references and, therefore, claims 9, 17 and 25 are allowable. As a result, dependent claims 10-16 and 18-24 are allowable as being dependent upon an allowable base claim.

Allowable Subject Matter

The Office Action indicates that claims 2, 10, 12-14 and 18-22 are allowable, presuming that the rejections discussed above under 35 U.S.C. §112, first and second paragraphs are overcome. As discussed above, these rejections have been overcome. Accordingly, claims 2, 10, 12-14 and 18-22 are allowable for this additional reason.
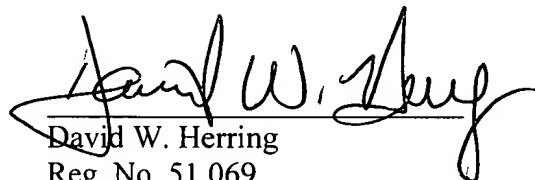
Conclusion:

The Office Action has recognized that claims 2, 10, 12-14 and 18-22 are allowable as long as the objection and rejections of those claims under 35 U.S.C. §112 are successfully addressed. In response to the objection to claims 3-6 and 19, Applicants have amended claims 3 and 19 to remove reference to multiple claims. Thus, claims 3-6 and 19 are each properly dependent upon one claim and, as a result, this objection has been overcome. In response to the rejection of claims 1-8 under 35 U.S.C. §112, first paragraph, Applicants have amended claim 1 to more particularly point out and distinctly claim the subject matter of claim 1 and the claims that depend upon that claim. Accordingly, this rejection has been overcome. In response to the rejection of claims 1-25 under 35 U.S.C. §112, second paragraph, Applicants have amended independent claims 1, 9, 17 and 25 to more particularly point out and distinctly claim the invention. As a result of this amendment, the structural connection between the elements of the claims is clear and, it follows, this rejection has also been overcome. Applicants have traversed the rejection of claims 1, 7-9, 11, 15-17 and 23-25 under 35 U.S.C. §103(a). For the foregoing reasons, the Office Action has failed to show that each and every element of independent claims 1, 9, 17 and 25 of the present application are taught or suggested by Levin and Yeap, either alone or in combination. Therefore, claims 1, 9, 17 and 25 are allowable. As a result, claims 2-8, 10-16 and 18-24 are allowable as being dependent upon an allowable base claim.

Therefore, applicant requests allowance of claims 1-25.

Respectfully submitted,

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